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Summary of the Boulder Entry Probe Workshop

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Introduction: An Entry Probe Workshop (EPW) was held April 21-22 in Boulder, Colorado, USA. Besides the twelve member Science Organizing Committee, there were an additional sixteen invited participants. The goal of the EPW was to produce a roadmap as to the use of atmospheric entry probes/landers for addressing the science objectives given in the Solar System Exploration Decadal Survey (SSEDS) produced for NASA by the National Research Council. The EPW roadmap outlines what the EPW considered to be the highest priority probe/lander science objectives, and identifies the highest priority probe technology development requirements. Outer planets, emphasizing Jupiter, and Venus were included as potential targets for probes/landers. Mars was not included in the EPW deliberations, because there is a separate Mars program within NASA which has its own set of science priorities and technology development schedule.

Conclusions from the Boulder Entry Probe Workshop: The principal conclusions of the EPW are the following. Particular "Big Picture" questions regarding Solar System evolution and planet formation exist that can best be addressed by entry probes/landers, or a combination of entry probes/landers and complementary remote sensing observations. Not surprisingly, this is consistent with the conclusions of the SSEDS. The required science measurements include, determining the mineralogy and elemental composition of the surface of Venus at a variety of sites, especially including tessera, measuriing the composition of the atmosphere of Venus, in particular noble gas abundances and isotopic ratios, and measuring the abundances of key atmospheric trace gases such as water and sulfur bearing compounds. With regard to Jupiter, measuring the global water abundance is of the highest priority, followed by supporting elemental and isotopic measurements. Other priority Jovian measurements include measuring the deep atmosphere thermal structure (static stability), deep winds, and radiative energy balance at multiple sites. An EPW consensus was that a Jupiter entry probe should be advocated as part of the planned flagship Jupiter Icy Moons Orbiter (JIMO) mission. To this end, two presentations on behalf of the EPW were given at the JIMO Community Workshop held at the Lunar and Planetary Institute, June 12-14, Houston. At the time of preparing this abstract, the JIMO Science Definition Team was considering inclusion of a Jupiter entry probe in the JIMO mission, but no decisions had been reached. The EPW strongly concluded that among the technology issues identified for probes/landers, ablative thermal protection for atmospheric entry is clearly the most significant issue that has to be addressed, and it requires immediate attention. This is a mission enabling technology. Mission enhancing probe/lander technology issues include operations at high environmental pressure (? 100 bars) and temperature (? 700 K). For example, high temperature sample acquisition on the surface of Venus requires attention, and improvement of communication capability from either Venusian or Jovian entry probes at pressure depths ? 100 bars needs study. Time is of the essence in implementing probe technology development because of mission timelines and dwindling technology bases in key areas. This is especially true in the area of thermal protection during either high speed atmospheric entry or aerobraking. Probe/lander instrument development can probably be accomplished through existing instrument development programs. There may be an advantage in terms of weight and power to considering integrated instrument packages on probes/landers.